ET 93-62

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Honorable Reed Hundt, Chair, and
Commissioners Rachelle B. Chong, Susan Ness, James H. Quello
Federal Communications Commission
1919 M Street N.W.
Washington, DC 20554

c.c. Richard Smith, Chief,
FCC Office of Enigeering and Technology

Dear Chariman Hundt, Commissioner Chong, Commissioner Ness, and Commissioner Quello:

Re: - Decisions to be made by the Federal Communication Commission by August 6, 1996 regarding radio frequency (RF) environmental health regulations, and some observed deficiencies and potential dangers to health and quality of life in the current FCC proposal, and proposed different and additional requirements.

- Please place in the official record as an **ex parte** submission to [redacted]

Preface: When reviewing this letter please consider the words of Winston Churchill,
"Our difficulties and dangers will not be removed by closing our eyes to them."[1]

Please follow the policy which the FCC has already committed to, which is that the FCC,

"would prefer to defer to the expert federal health and safety agencies for guidance in this area" [FCC OST Bulletin No. 65, 1985 pg. 4].

This approach will help assure public trust, prevent being swayed by those biased toward a particular standard, and encourage wise decisions. Please only consider making *more* restrictive and protective limits than the federal health agencies may recommend (such as if there is more information).

On April 8, 1993, the FCC issued a proposed Notice of Rule Making (NPRM) to adopt the 1991 RF health protection standard of the Institute of Electrical and Electronic Engineers (IEEE), C95.1-1991 ("IEEE 1991"), which was adopted by the American National Standards Institute in September 1992 (1992 ANSI/IEEE). Now, IEEE 1991 is almost past the 5 year life allowed for all IEEE standards and this is almost out-of date

- IEEE 1991 does have some improvements. These include:
(1) A two level exposure system, so infants, children and others in their homes who are unaware of the exposure will not have the same level of RF exposure as workers with RF jobs who are

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aware of their exposure and for whom there is a health and safety program to mitigate exposure effects,

(2) Exposure limits for some induced and contact currents and for RF shock and RF burn from grasping metal handles of vans, school buses or other large metal objects irradiated by RF.

(3) Limits to prevent high power RF pulses from causing unconsciousnous in people.

(4) Averaging time limits to prevent RF skin burns which could occur during short exposure periods.

However, IEEE 1991 also has deficiencies in its exposure limits, rationale, and process in which it was developed. Some of these deficiencies have become apparent from recent recent research. Now Congress is requiring that the FCC complete action on this almost out-of-date standard with numerous deficienies.

- **Reasons for concern:** These deficiencies which shall be described herein can have greater impact now on the health and well being of the nation than historically, because instead of affecting a small part of the population near radio and TV broadcast towers, these standards can now be expected to have significant impact on the general population and workers of the nation.

This increased impact is expected because soon on many, if not most streets of the nation, on electric utility poles, roof-tops, bill boards, traffic signs, and other structures will be placed wireless telecommunications services broadcast transmisson antennas [for example see Seattle Times, July 19,1996, and Exhibit *I*]. The typically powerful horizontal beam may more likely be able to directly irradiate into rooms of the same height on the level of the upper floors of homes, schools, hospitals, restaurants, hotels, and office workplaces, and private systems may irradiate factories, warehouses, airports, retail malls, school campuses and other large facilities for the general public or workers.

Also, exposure is expected to increase because to reach the same geographic area more power is needed to output from a transmitter if it is a lower heights -due to both the distribution of signal power when the source is closer to the ground, and due to the increased attenuation from trees and buildings which must be overcome with greater power. Hence lower antennas will increase exposure both because for the same amount of power exposure is greater when the attenna is lower, and because the lowering of height will necessitate often an increase in the power to reach the same area as would a higher height antenna. Thus, reports by the cellular industry that *"most base stations are 150 feet or so in the air"* [Federal Focus 1995, pg. 23] may reflect more the historical experience than what may be expected in the future.

The above can potentially increase exposure by more than 500 fold what has been typical of public exposure to radio frequency (RF) from wireless base stations. Typical has been 1 microwatt/sq. cm [Federal Focus, 1995, pg. 22]. Now two 3000 ERP Watt antennas, 35 feet and 45 foot high antennas in the Seattle, Washington area could cause the limit of 580 microwatts per sq. cm to be reached if at some future time buildings nearby are built to be the same height as the antennas- see 2 examples in Exhibit *I*], and increase exposure to RF by 100,000 fold more than the typical median RF exposure of the general popultion [since median exposure in urban areas

reported by EPA was 0.005 microwatts per sq. cm. in [EPA,1986, page 27323] and 0.005 is less than 1/100,000th of 580]] if FCC proposed exposure levels are approved. Also, the special frequencies of cellular phone and personal communication services can cause 'hot spots' in the human head and body [IRPA, App. 1. 1988], and also cellular phone frequencies are less attenuated by buildings than lower frequencies [Smith, A, 1978, OT Report 1976,NTIA 1994, NTIA 1995]. Indeed, one study of 900 MHz showed 25% of the indoor locations were not attenuated at all.[NTIA, 1994, Fig 20].

Furthermore, evidence suggests digital telecommunications signals may under some conditions have effects similar to those of electric utility power lines about which research is finding suggestions of detrimental effects [see Exhibit 2, NATO ASI Series (1995), EPA 1993 conference pg 15-16]

Infants and children, moreover, especially those from low income families, may be more affected by the deficencies to be described than the adult population. This is because infants and children, especially newborns, have small bodies which are closer to the 13 inch length of cellular phone frequencies and 6 inch length of Personal Communications Services [see IEEE ref. [B22] and being near in size to the wavelength results in more efficiently absorbing its energy; hence infants may absorb up to 200% or more energy that an adult absorbs for these frequencie [B22 shows for an average man at 900 MHz "E" orientation (near cellular phone frequency) 0.03 W/kg in Fig. 6.4, vs. for a 1 year old child an average specific absorption rate (SAR) of power of whole body absorption rate of 0.065 in Fig. 6.10]

Also, a large proportion of infants and children are living below poverty levels and it has been observed that adverse growth effects have occured in laboratory animals irradiated with RF when they had poor nutrition but less so otherwise, for example *"pupae in excellent condition develop fewer irradiation-correlated abnormalities"* [see Green, D et al,1977; and reviewed in Pickard et al. 1979], and,

"When similar chicks were exposed to a UHF field (880 MHz), growth depression was severe (when the chicks were) grown on a low protein diet, low-energy diet. The birds ...which grew much better received a high-protein, high-energy diet. It would appear that the superior diet ...may have offerred the birds some protection from the effects of the UHF electromagnetic field."[Giarola et. al. 1974]

In addition, 'foil-backed' insulation or aluminum siding can greatly reduce indoor RF exposure [Smith , A,1978, NTIA 1995, NTIA 1994, OT 1976], but may not be as often in the more modest homes of low income families. Finally, low income families more often live in the retail and commercial areas where larger and more powerful wireless facilities may more likely placed in lieu of placement in residential areas. Hence, low income persons may be especially at risk to potential radio frequency effects.

Finally, an effect which will greatly affect infants and perhaps small children more than others is a reduction in REM sleep due to exposures 1/10th of that considered "safe" by proposed FCC limits and which occurred upon exposure to signals similar to those of cellular telephones. Moreover, there was not only a reduction, but a systematic increase in EEG signals during REM sleep and systematic decrease in EEG signal strength during other phases of sleep. This is a significant discovery recently published by Mann and Roschke (1996) This dramatically changes the

consideration that must be given to proposed FCC limits, and especially due to how infants and small children may be affected by RF from cellular phone signals. This is because,

"REM sleep plays a special physiological role for information processing in the brain. Here selecting, sorting, and consolidating of new experiences received during the waking state were performed as well as linking them together with old experiences. For this reason, modification of REM sleep patterns induced by electromagnetic field may be associated with an alteration of mnestic (relating to memory) *functions and learning processes." [Mann et al. 1996]*

Also, the diameter of the head of newborns and small infants is close to being 1/4th of the length of the 13 inch cellular phone waves, which is the optimum diameter for the head to absorb the strongest signal. Also, since infants sleep much during the day and early evening when cellular phone use is high they are also at greater risk. Finally, during the early period of an infant's life probably much integration of experience into memory and into learning processes is occuring. Hence the impact of this higher exposure may be significant
]
Given what is known of the importance of REM sleep this discovery cannot be ignored. There must be action taken to assure this technology will not affect the sleep of people, especially infants. Until research determines that this affect is not a hazard it should be presumed so, given what is known about REM sleep. Hence, unless a wireless operator has an effective means of assuring such exposures will not occur, the exposure limits must be reduced in areas where people live (including mixed use areas with some residential use)

A public health conservative approach would be to use a factor of 10 to 'guesstimate' a threshold for the type of experiment that was done. Then apply a 'safety factor of 100 to try to take into account chronic effects, individual differences, effects of medication, and other factors. 100 is the 'safety factor' or 'uncertainty factor' that the Environmental Protection Agency has identified as traditionally used [EPA, 1986, pg. 27329]

Overview of findings and FCC actions needed:

1. IEEE exposure hazard threshold is set much higher than the exposures at which many adverse effects occurred among the very papers which IEEE 1991 claims was reviewed for preparing the standard: One key deficiency included the setting of the IEEE 1991 hazard level inappropriately too high even based on the papers claimed it did review for establishing its hazard thereshold. This is because among the List of Final Papers Reviewed for IEEE 1991 includes 11 studies reporting adverse effects at levels ***below*** what a majority of the IEEE 1991 Risk Assement committee declared was the hazard threshold for adverse effects found among these same papers. These adverse effects found in the papers reviewed by IEEE 1991 and ocuuring below its selected hazard threshold include:

(a) 3 studies finding cancer accleration,
(b) 4 studies finding disruption of performance of learned skills or learning of new skills,
(c) 3 studies finding damage or anomalies in central nervous system tissue
(d) 1 study finding fetal anomalies (cranioschisis and a 'panorma' of other anomalies)

Indeed, for one IEEE 1991 final list paper [Belokrinitskiy, 1982, IEEE 1991 pg.61] in which the author concluded were pathological changes in brain tissue. the exposure levels were as much as

1000 times below the IEEE selected hazard threshold, which supposedly was based upon a IEEE 1991 review which included this paper.

For details on the above 11 papers please see Technical Note #2.

2. As much as a two fold increase in exposures for the higher frequencies is allowed by IEEE 1991, and the additional safety factor is eliminated for the more restrictive tier so that all persons have the same exposure limits. It will be shown that 5 key references cited by IEEE 1991 which include focused discussions on millimeter wave exposure explicitly provide information indicating that the IEEE 1991 limits for the general population are inappropriate, and may cause people to feel uncomfortably warm as well as have perhaps more serious effects. For further information see Technical Note #8, and see the 1986 standard of the National Council for Radiation Protection and Measurements [NCRP 1986] which has at least 10 references that address millimeter wave issues (some are also shown in the Technical Note #8].

These and other deficiencies to be discussed are expected to suggest concurrence with the conclusion of the U.S. Environmental Protection Agency (EPA) which wrote the FCC (after noting the exposure increases in the millimeter range and setting the same exposure for both tiers)

"Therefore, EPA recommends against adopting the 1992 ANSI/IEEE standard because it has serious flaws that call into question whether its proposed use is sufficiently protective of public health and safety, " and,

support the view of the Food and Drug Administration that,

"In our opinion, it is unclear what types of biological effects and exposures are addressed by the standard," and

support the view of the National Institute of Occupational Safety and Health (NIOSH) that

"The exposure levels that would be set by the standard are based on only one dominant mechanism - adverse health effects caused by body heating."@, and Letter of NIOSH to FCC JAN 11, 1994

support the similar view of the EPA that the limits of IEEE 1991 are,

"based on a thermal effect."@ EPA letter of Nov 2, 1993

The claim of those supporters who say IEEE 1991 looked at all effects, thermal or not, is problematic. This is because the significant adverse effects shown above were among the very papers that were claimed to have been reviewed when deterimining the IEEE 1991 hazard threshold, but occured at exposures below, and often far below that selected by IEEE 1991. Hence, all adverse effects in IEEE 1991 final papers reviewed were not addressed in determining its hazard theshold, contrary to the claim of IEEE 1991 supporters.

Consequently action is needed by the FCC to establish protective exposure limits, even if based only on the lowest exposure among the IEEE 1991 final list papers which showed adverse effects.

Minimum FCC action needed: Also, at minimum, the FCC should withdraw those features to be discussed below with inadequate exposure limits in the proposed standard and where current FCC criteria are more protective. In addition, changed and additional criteria should be included it its final rule to overcome the deficiences to be noted

Processes need to be established to keep "exposures as low as reasonably achievable.": There is a strong need to assure that the final rule has within it documentation indicating the protection provided by the standard and areas of concern about IEEE 1991, and adverse effects observed below the hazard level upon which IEEE 1991 protection limits were derived e.g. the letters of federal health agencies submitted to this docket, a summary of the problems noted in this letter, and summaries by federal health agencies of other studies which found important biological effects or adverese effects.

Give local jurisdictions authority to implement ALARA and to give input during licensing review: In addition, the FCC needs to announce a policy of keeping exposures "as low as reasonably achievable" (ALARA), and accordingly give local jurisdictions the authority to implement this policy by their being able to excercise judgement when deciding on use permits. Similarly, the FCC process for applying for a license needs to provide for public and local jurisdiction input.

Establish approved 3rd party organizations to make recommendations to the FCC: To allow for such extensive inputs, the FCC should establish FCC approved organizations who, (like Certified Public Accountants) can be relied upon to use proper procedures and full investigations when preparing their enviornmental impact reports, recommendations to the FCC, and periodic monitoring reports of wireless facilities; annual approval should also be contingent upon the local jurisdictions indicating satisfaction with the unbiasedness and competence of these organizations. Monitoring should occur before and after facilies are placed and should include measurement of the exposure levels in the frequency spectrum arrange allocated to each wireless operator, and include both electric and magnetic field measurements, as well as detailed modulation characteristics so the epidemiological data will be available to study modulation effects on health.

More on local authority: Other state and local jurisdiction authority should include control over visual appearance, height, noise, fencing, landscaping, keeping use permits conditional and other factors important to local jurisdictions as long as the effect of such controls still permits the reasonable operation of wireless networks.

To assure proper protection of the public health, a timely response to new health effects research or a bringing to public attention of existing research requires the FCC delegate authority to the courts or others who may make timely decisions. Authorizing states and local jurisdictions to collect fees and taxes dedicated to RF educational, research, and monitoring efforts needs to be granted.

Long term strategies needed to implement ALARA- what can be the role of satellites?: Since RF broadcast facilities are planned to be placed on electric utility poles additive or interaction effects need to be studied, and the FCC otherwise needs to outline what information is needed for it to make proper decisions. Since signal strength decreases as distance from an RF source increases to reach distant regions of a broadcast facility's service area requries high exposures of those living close to the antenna - broadcast by satellite may reduce this uneven and often high exposure levels and provide uniform very low level exposures instead, so the FCC needs to explore what policy directions would help study the merit of this speculation, and if valid how to encourage it to develop

The deficiences in exposure limits include:
(1) Inappropriate selection of an exposure hazard threshold level which appears too high and which is as much as 1000 times greater than exposures at which adverse effects were observed, (already discussed)

(2) A system of 2 levels of exposure that inappropriately is based largely on awareness of expsure,

(3) Dangerous increases in the exposure level at the short millimeter and near millimeter wave frequencies (above 6000 MHz) to as much as 200% of current levels. This level of exposure violates the basic provisions of the standard to assure localized exposure does not exceed 1.6 W/kg for the general population. 10 mW/sq. cm results in an SAR in the eye of 2.6 W/kg [Kues, 1985, and as reported in WHO, 1993, pg. 122] Note. This SAR occurred at 2450 MHz. At higher frequencies, it is known that penetration is more superficial. Hence the RF power can be expected to be concentrated in a smaller volume, resulting in an even higher SAR. Thus, a violation of the basic provisons of the standard is reasonable to expect

(4) Expected violations of the basic protections of the standard due to increases in the frequency range from 1500 MHz to 6000 MHz, and due to recent research that suggest lower power density is needed.

(5) Expected violations of the basic provisions of the standard in range below 1500 MHz due to recent reasearch indicating body absorbs more RF power than previously predicted.

(6) A deficient method of determining allowable partial body exposures, which results in out-of-compliance exposure levels with the standard with which IEEE 1991 claims compliance,

(7) Magnetic field level increases which are inappropriate and probably dangerous,

(8) Insufficiently justifed increases allowed of exposures to the hands, wrists, feet and ankles,

(9) Inappropriate and restrictive criteria for determining if a localized part of the body is receiving excessive exposure,

(10) Insufficient limits to protect from the sometimes annoying, stressful, and perhaps dangerous chronic exposure to the click, buzz, or chirp of 'microwave hearing' due to high peak energy pulses which are likely due to a thermoelastic expansion wave in the brain,

(11) Induced and contact current limits that are not sufficiently protective, and which are expected to be exceeded due to allowed external field limits,

(12) Inappropriate exclusion of low power hand held devices whose use may exceed basic provisions of the standard.

(13) Not considering impacts of exposure on interefence with sensitive medical devices that may be in medical facilities or in the home, and other interference such as affecting telephones.

(14) Time averaging based on 30 minute cummulative exposures is not as protective as some internationl standards and which are inconsistent with IEEE 1991's own claims that there are not cumulative effects.

The deficiencies in the rationale of IEEE 1991 include
(1) Assumed 'conservative assumptions' which are either not valid or not valid for many important exposure conditions,

(2) Unsupported conclusions on which the validity of the standard depens and which are in conflict with statements in the standard itself, the findings of other standards, federal health agencies and the medical and science based literature.

(3) Selecting for the higher RF frequencies an inappropriate Safe Use for Lasers standard exposure limit as appropriate for the general population, even when the Laser standard has limits expected to be "uncomfortable to view or to feel upon the skin".

(4) Assuming cell culture studies did not demonstrate potentially harmful effects, even if the study authors found otherwise,

(5) A claim of "safe for all" given all of the above, it is inappropriate and found "unwarranted" by EPA and similarly by the National Institute of Occupational Safety and Health (NIOSH) and the Food and Drug Administration (FDA).

The deficiencies in the process of developing the standard include: (See Exhibit 3 for details)
(1) Inadequate representation from health agencies on the IEEE balloting committee with only 3 of 36 balloting committee members being from health agencies, 31 being users of RF or consultants or contractors to users.

(2) Voting against adopting IEEE 1991 were 66% (2 of 3) of health agency representatives, indicating lack of consensus and health agency support for this standard, and gave as reasons:
(i) inadaquate representation from health agencies was acknowledged but not addressed by the assigned IEEE committee - proper balance may have resulted in not adopting IEEE 1991.
(ii) Inadequate review process with apparently no federal health agencies reviewing a draft contrary to agreements,
(iii) "very weak justification" for increasing exposure at higher frequencies
(iv) "brushed aside" important scientific papers showing pulsed signals have effects at lower exposure levels that continuous wave signals

(3) Minority viewpoints can persist during reviews of drafts due to a required 2/3 super-majority to change or delete text; this resulted in a failed attempt by one of two phyiscians on the IEEE committee to have removed a claim that EPA found "unsupported" by EPA and the 1986 standard of the National Council for Radiation Protection and Measurements - raising further questions about the extent IEEE 1991 decsions were science based.

Recommendations:

A. Recommendations regarding exposure criteria features:

(1) Two tiers based on population and occupation: Adopt the FCC proposed modifications (in Section #13 of the NPRM) of the IEEE 1991 defintion of its two tiers, and define the tiers with

(i) the more restrictive being the general population and non-technical workers for whom there is no appropriate RF health and safety program, based on the recommendations of the Occupational Health and Safety Administration (OSHA) , to prevent or mitigate effects of exposures above those allowed for the general population, and

(ii) the less restrictive tier being for RF technical workers for which there is such an OSHA recommended RF health and safety program

This is consistent with the recommendations of the EPA to adopt, with a modification, the NCRP 1986 standard, and is supportive of concerns of NIOSH, and OSHA,

(2) A minimum FCC action to contain damage: The FCC should note that at a minimum it can withdraw from its proposal those specific features which are problematic, and/or for which current FCC limits are more protective. Thus, were the FCC to follow this option it could withdraw the entire IEEE 1991 proposal, except

(i) Keep the lower tier power density and electric field levels through 7500 MHz, this is more protective than current FCC limits and extend current FCC limits to 300 MHz. Of course more restrictive limits such as NCRP 1986, or those of the 1986 National Radiological Protection Board which are 40% of NCRP 1986 (and 4% of IEEE 1991 would be improvements.

(ii) Keep the time averaging periods above 15000 MHz, this is more protective than the current FCC limits or NCRP 1986. Otherwise apply current FCC time limits to both tiers - resulting in limits below 15000 MHz identical to those of the International Radiation Protection Association.

(iii) Keep the limits for Peak Power and Induced and Contact currents as given, but with OSHA restriction that to exceed the more restrictive tier limits an appropriate RF health and safety program is needed. Ideally, currents no greater than in Table 2B should apply to all populations, as recommended by Dr. Om. Gandhi, co-chairman of IEEE 1991.

(iv) Keep the local SARs for partial body exclusions for the more restrictive tier. These are better than now, but not as protective as NCRP 1986.

(v) Keep the Definition sections but withdraw from definitions the terms for 'controlled' and 'uncontrolled' environments and Maximum Permissible Limits since the definitions are irrlevant or inaccurate (IEEE MPEs do not assure no exposure to harmfull effects), and replace giving the definitions of the tiers as in (1) above. Define the interpretation of the limits by refering the reader to the letters of the federal health agencies which discuss this matter. The FCC should definitely not contradict the explicit message of FDA, EPA, and NIOSH which indicate that the limits should not be presumed to provide protection from all mechanisms.

(vi) Modify the statement concerning basic protection of the standard so that if it is shown that the average whole body SAR of 0.4 W/kg or 0.08 W/kg for the two respective tiers is

violated, regardless of the power density, then an out of compliance condition occurs. Likewise, require this for localized SAR values, e.g. if it is shown that for other than the hand, wrist, feet and ankles, that a localized SAR of 8 and 1.6 respectively for the two tiers is exceeded, then an out of compliance condition occurs.

(vii) Modify the measurement section so it is consistent with above changes, but state that measurement of near field objects is needed to verify partial body SAR exposure criteria is met. Also state that all details of modulation specifics are needed. State that induced current measurements as recommneded by Dr. Om Gandhi to the FCC in his letter of October 22, 1996, should be part of the standard documentation required, especially since IEEE electrical field limits are expected to cause induced currents to exceed their limits.

Measurement should also include power density measures in the specific frequency band allocated to each operator, as well as total exposure. The protocol described in Exhibit should be followed to determine the "before and after" effects of installing a facility.

Also state that measurements and predictions should include reasonable 'worst case' conditions, and include:

(a) A provision for estimating the effects of wearing metal eye-glass frames. Davias and Griffin (1989) report that wearing metal eye-glass frames can increase the electric field 10 fold (e.g. increase the power density by 100 fold). They report the following:
Lowest order resonant frequencies for each isolated segment of metal frame spectacles:

Segment	Resonant Frequency
Wing (along side of head)	1400 MHz (somewhat close to PCS frequencies)
Hook (around ear)	3750 MHz
Rims (to hold lenses)	1400 MHz (somewhat close to PCS frequencies)
Complete structure	900 MHz (very close to cellular phone frequencies

The authors studied electric field strength for a phantom head with and without spectacles. They report,

"...there is an increase in radiation levels relative to the phantom of up to 20 dB (10 fold) for frequencies below 6000 MHz..."

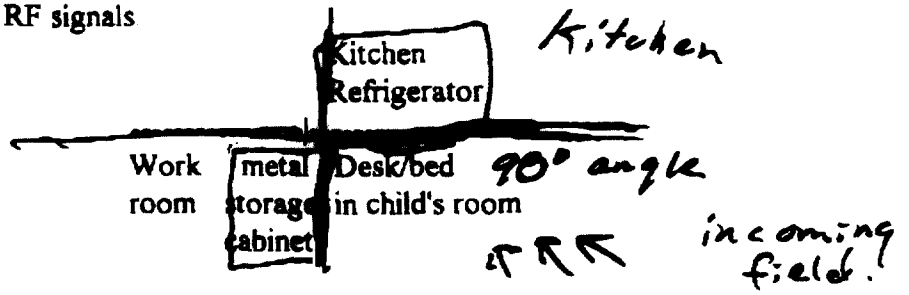
State that the analysis of Kues, 1985 to estimate local SAR in the eyes of primates can be used, and assume that for personal communications services the SAR of 0.26 W/kg per 1 mW/sq cm applies, unless the person preparing an analysis shows otherwise. Assuming the fluid in the eye allows equal distribution of heat then for both cellular and PCS frequencies the above approximation should be close. To keep the eye SAR less than 1.6 then at most 6.15 mW/sq. cm is allowed. Since, the local electric field can increase 10 fold for frequencies under 6000 MHz if metal framed are warned (as reported by Davias et al), then power density can increase 100 fold.. This method of estimation should be used when computing exposure to the eye.

(b) It has been calculated that 90 degree corner reflections off conducting surfaces can increase exposures 16 fold using standing wave theory and 20 fold using antenna theory [Gandhi, 1977] using perhaps the less controversial 16 fold value should also be used in determining actual exposures in reasonable 'worst case' situations

Hence, when making measurements and predictions, to be reasonably conservative the FCC should state that it should be assumed, unless it can be demonstrated otherwise, that such 90 degree corner exposures will occur and to make predictions accordingly. Examples include:

- placing a child's play pen or infant seat in the 'shade' of the corner of a building with aluminum siding.

- placing a child's bed or desk into a corner where on the opposite 2 walls may be large metal objects such as a refrigerator and metal storage cabinet which together form a 90 degree metal conducting surface to reflect RF signals



(viii) Withdraw Explanation and Rationale sections because they are no longer relevant or contain unwarrented, unsupported, and inaccurrate statements. Let the FCC prepare its own rationale, relying on any reasonable sources.

(ix) Only keep those new magetic field exposures which are less than or equal to current FCC limits. The magnetic field for the lowest frequency in the spectrum range should be no more than the current limit at the lower end of the current spectrum range. The current magnetic field limits should be kept for frequencies above 300 MHz, since IEEE 1991 does not specify them. At the higher frequencies magnetic and electric fields are usually associated, and this may be why magnetic fields are not given above 300 MHz. But certain buildings and materials may attenuate electric fields differently than magnetic fields, so inside a building the expected assocaiton may not occur. Both specifications are needed.

3. Specifiy that the "auditory effect," e.g.microwave hearing should not occur, and that transmission patterns or peak power need to be altered to prevent such occurence.

B. Recommendations regarding process of implementing standard and monitoring

(1) Follow the fundamental directive of assuring FCC and wireless operators are responsible for *"fully informing the worker and the public of the limits of knowledge"* regarding RF health and biological effects, as provided for in the NCRP standard recommended by the EPA - accomplish this by including letters received from federal health agencies regarding this docket into the FCC standard and into informational meterials required to be given to the public, potential lessors, and local and state jurisdictions by wireless operators. Also inlcude summaries of studies noted herein and those identified by others as suggesting adverse health effects or biological effects.

(2) Adopt a FCC policy of "prudent avoidance" and direct local jurisdictions to issue permits only upon evidence that exposures from wireless facilities "are as low as reasonably achievable" (ALARA).

(3) Implement the ALARA policy by providing for each FCC license request for a specific site that

(i) prior to signing a lease a potential lessor is given FCC required informational materials, and a public meeting is held with the local jurisdiction being informed to discuss proposed sites and alternative sites for achieving ALARA goals -materials would include emphasizing that higher antennas result in lower exposure levels, and would suggest 'lool-like-trees' antennas and other ideas for high height visually attractive antennas,

(ii) operators notify the public and local jurisdictions of the requested license and provide to them required FCC informational material and instructions for providing input to the FCC on whether ALARA goals are met for this application and if there other enviornmental mpact concerns, and

(ii) local jurisdictions are required to process use permit requests only after a FCC license is issued, and

(iii) require or, if not possible, recommend all use permits be conditional given uncertainty of exposure levels and possible health effects, and that exposure levels may be made more restrictive, even when there is uncertainty, based on principles of caution derived from research documenting biological and health effects of concern.

(4) Monitoring of exposures from all RF FCC registered sources needs to be done and reported with an application for a new or renewed license, or as part of periodic monitoring by the FCC approved reporting organization.. The exposure in the frequency band and total exposures shall be reported, and shall include descriptions of modulation characteristics as well as intenstiy levels. Predictions of exposure, and monitoring shall also indicate various 'worst case' scenarios, and include:

(i) Exposures when a person is in a 90 deg. corner with RF reflective surfaces (e.g. the corner of a home with aluminum siding)

(ii) Exposures to the eye shall include re-radiation effects from metal eye glass frames, as estimated using the methods of Davias et a. (1989) which finds up to a 10 fold increase in the electric field, or other appropriate method may be used with appropriate justification.

(5) Establish FCC approved 'RF reporting ' organizations who, unless disapproved by local jurisdictions, perform ALARA analyses, RF evironmental impact studies, and RF exposure monitoring, hold public meetings, and otherwise gather information and report recommendations to the FCC. This is recommended recognizing there are limited FCC resources and staff to perform in-depth processing of FCC applications, and uses a model similar to that used for other environmental impact studies. Preference shall be given to public authorities, civic or environmental organizations to become FCC approved RF reporting organizations, or to such organizations who present recommendations from such public authorities, civic, or environmental groups.

(6) In addition to having the above authority states and local jurisdictions shall have authority to control the appropriateness of the construction method and location from a construction point of view, fencing and other safety related issues, adverse impacts on designated environmentally sensitive areas, noise from air conditioning units of the facility or other facility noise, landscaping, height, visual appearance, and other issues related to compatibility with the local area, but with the requirement that the operation and ddvelopment of these wireless networks.

(7) Recognize that to protect the public health, that the standards setting process is cumbersome, does not occur in a timely manner, sometimes does not occur in an effective and representative manner (as seen above), and consequently that a mechanism for timely adjustment of the FCC health protection standard may be essential for protecting the pubic health as new studies are reported or existing research is brought to public attention. Accordingly,

(i) The FCC should specifiy that if a court of law for a certain jurisdiction finds there is reasonable evidence that adverse health effects have occurred in animals or humans at certain exposure levels, then for that jurisdiction protection limits for the general public equal to 1/100th of the exposure at which a adverse effect was found shall be permitted, and 10 fold this level shall be associated with the less restrictive tier for RF technical employees with an appropriate RF health and safety program that adequately address the adverse effect in question.

(ii) Likewise, since EPA, NIOSH, and FDA noted a lack of willingness by IEEE to consider certain important studies, and NIOSH specifically identified a "lack of public health perspectiv" let the FCC establish a public health advisory group, which may eventually develop its own recommended standards, and predominantly including civic organizations (Common Cause, League of Women Voters), environmental organizations, and federal, state, and local public health agencies, public health professional organizations, e.g. American Public Health Assocation, Phsicians for Social Responsibility, National Association of County and City Health Officials, and some representation from members of schools of pubic health and other research institutions - but where such individuals do not provide consulting or receive contacts from wireless services industries or military users, thereby avoiding bias or the perception of bias.

(iii) The FCC should establish requirements for the standard setting process for an organization to follow if it wishes to be considered as a standard by the FCC. These requirements would include overcoming the deficiencies in the IEEE 1991 development process mentioned above. The FCC may, for example, require that a non-federal standard while it is still in draft form and not yet adopted have its draft reviewed by federal and state agencies, as well as by professional health organizations and environmental and civic groups, as well as notification in engineering and public health professional and governmental publications. This will help assure widespread review and appropriate modifications that will further instill public confidence in the future standard.

(8) Obtaining funds by local jurisdictions and states from taxes or fees from wireless operators for the exclusive and dedicated purpose to undertake RF investigations to meet ALARA goals, RF educational efforts, RF epidemiology or basic research associated with RF health and safety concerns, or to do research and testing on developing technologies which may help reduce RF exposures and RF potential shall be permitted within FCC rules regulating state or local jurisdiction control of RF wireless services.

Just as trucking firms pay license fees, or drivers pay gasoline taxes dedicated to highway maintenance and development, so to is it appropriate for wireless operators to pay taxes or fees dedicated to public concerns related to RF health effects

(9) One of the main areas of research not addressed by current efforts is the study of any interactions between RF electromagnetic fields, and power line electricmagnetic fields. This is because one of the main places being considered to place RF broadcast antennas is upon electric utility poles throughout urban residential and commerical areas. Whether effects may be additive or otherwise and what those effects may be needs to be well understood since this pattern may become prevelant throughout the nation.

(10) Integrate into long term FCC policy planning and recommended research efforts to determine whether a fundamental problem with RF exposure may only be solved by an integrated cooperative system whereby

(i) RF signals to users are broadcast from satellites so that very weak signals reach users and the general population, and

(ii) RF signals from users are sent via nearby "receive only" ground station antennas placed throughout urban aeas, so that weak signals broadcast by users are not a health hazard for them or those persons near them.

The fundamental problem 'driving' the suggestion for the above possible solution is due to RF exposure levels decreasing with the square of the distance. Thus, if there is a 2 fold increase in one's distance in the same direction from an antenna, then the exposure level typically drops by a factor of 4. Hence, for ground based wireless services broadcast stations to reach the most distant location with the faintest signal still perceptible. locations much closer must endure far higher exposures.

In contrast, were broadcasts to come from satellities, then all areas receiving a distant narrow RF beam would experience the same very low level of exposure. In this way, might be eliminated the much higher levels which must necessarily fall upon those living closer to ground base stations than those at the outer edge of the broadcast area.

Whether the above, in conjuction with other means is a viable solutions needs technical and policy research funds. The FCC must take a leading role in seeking means to obtain such funding and advising Congress and other agencies of funding and research efforts needed.

More Exposure limit recommendations

11. The FCC should adopt limits for the general population/non-technical RF workier tier that do not exceed those of Dr. Om Gandhi's electric field and power density recommendations (do not use recommended magnetic field limits) as given in IEEE reference [B26, Gandhi, 1988] and given in Table 3-5 pg 42 of Gandhi (1990). This would meet many objectives.

- Would protect from perception based on finger contact with energized school buses
- Would protect from exceeding the more restrictive limits on induced currents
- Keeps local SARs near or below the current FCC limits of 8 W/kg (note this is still too high for the more restrictive tier, so further adjustments are needed)
- Keeps people from feeling "very warm to hot"
- Lowering of power density will help achieve for the general population the basic SAR provisions of the standard, considering new results indicating more power is absorbed than previously thought.

12. Also, the FCC limits for the general population/non-technical worker tier should be below the power density for the higher frequencies which have been identified as making people feel a "marked sense of warmth", given in Gandhi and Riazi (1986, on page 231) which is an IEEE 1991 final list paper. This level is 84% of the NCRP 1986 standard. Thus, NCRP is too high. Recognizing differences between people, the FCC standard should not, at the higher frequencies (e.g. above 1500 MHz), be any greater than about 1/2 the level at which a sample of healthy adults felt a 'marked sense of warmth," which is 1/2 of 0.84 mW/sq. cm. or about 0.4 mW/sq. cm.

The above level 0.4 mW/sq. cm, which is 40% of the NCRP 1986 is the standard for the residential areas of the United Kingdom National Radiological Protection Board above 1500 MHz. Thus, in addition to not exceeding Gandhi (1990) for electric field and power density, the FCC standard should also not exceed the limits of the 1986 standard of the NRPB of the United Kingdom.

13. Concerning millimeter waves, a partial review of the "non-thermal" literature shows there was an increased level of cell changes "morphoses" at 0.1 mW/sq. cm. (100 fold lower than the IEEE 1991 limit), also, many other changes at or below 1 mW/sq. cm. were identified, including a notation that in the range of 0.02 to 2.5 mW/sq. cm. there was a "7 fold increase in centromeric decondensation of A chromosomes."[Belyaev, 1992]. I am not qualified to interpret these biological effects. However, I do not believe workers or the general public wish to be exposed to levels at which these biological effects occurred, given the great uncertainty of long term effects. In this regard the reference noted,

"...there are many available publications of the ability of Extremely High Frequency EMR to produce heritable biochemical changes, morphological changes, and other changes, in microrganisms. As a rule, these changes result from a prolonged (many hours) EMR effect at resonant frequency, and apply to the devolopment of population, enzymatic activity, drug resistance.[Belyaev, 1992, pg. 17]

Given, the above observed changes at 0.1 mW/sq. cm., some may say apply a 'safety factor of 10' to obtain 10 microwatts/sq. cm. Indeed, this was the standard in the Soviet Union and many Eastern European countries, and as can be seen has a biological effects basis.

Yet, it seems more reasonable to apply a factor of 10 for to 'guesstimate' a threshold, and a factor of 100, which is traditionally taken, to obtain general population exposure limits, of 0.1 microwatt/sq. cm. for the millimeter and quasi-optical wave range (above 6000 MHz) for 24 hour exposure of the general population.

Thus, FCC standards should not exceed this safety limit to protect against the observed effect of morphoses (changes of structure seen in one cell organisms).

(iv) For exposure in the range in which average whole body SAR has meaning (0.1 to 6000 MHz), some might say the FCC should follow IEEE 1991 and use behavioral disruption as the indicator of for a hazard threshold. If so then, some may say:

-1 Chose 0.4 W/kg, because this is the lower end of the range 0.4 to 0.7 W/kg which a 1990 review of behavioral disruption found as the range in which a threshold lies. This would result in a 10 fold lowering of exposure limits due to a 10 fold lower hazard threshold. But since this level is now in a 'non-thermal' range, man's superb thermoregulatory system may not help, and

(DeAndrea + DeLorge 1990 in Chap. 13 of Gandhi 1990)

a traditional safety factor of 100 instead of 50 seems appropriate. This would result in exposure limits in SAR of 0.004, or 1/20th of the current average whole body SAR limit of 0.08, and a consequent lowering of all power density values by 1/20th.

-2 Chose a level below 0.2 W/kg since this was the lowest actually observed average SAR where laboratory animals given the medication Dextroamphetimine for treatment of Attention Deficit Disorder showed reduced performance of a learned skill. A level 1/4th or 1/10th may be selected as a 'guesstimate' of a threshold for this type of animal experiment, resulting in 0.05 and 0.02 W/kg. Applying a safety factor of 100, yields a protection limit of 0.0005 or 0.0002 W/kg, which is 1/160th or 1/400th of current power density limits

-3 Consider other adverse effects besides behavioral disruptoin which occurred at very low levels. It is found this includes:

Fraction of IEEE 1991 safety level for the 'general population at which exposure occurred.	Effect
0.2	1 -Patholoigical damage to the barrier between the blood and the brain at 915 MHz at levels as low as 0.016 W/kg (1/5th of 0.08)[Salford] 1994]
0.12	2 -Apparent damage to the blood brain barrier at 30 microwatts/sq. cm at 1200 MHz for the rat [Oscar] 1977, on IEEE final paper list #67]
0.1 (50 μW/cm²) and limit is about 590 μW/cm²	3 -18.5% reduction in REM sleep and abnormal REM sleep EEG patterns at 915 MHz European cellular phone transmission pattern.[Mann and Roschke, 1996]

This finding is among the most disturbing of the studies presented. This is because at frequencies used by European cellular phone systems, and very close to that in the Untied States, a study on human subjects found that both the amount of REM sleep was reduced and the EEG brain wave energy patterns were abnormal during REM sleep and all other sleep times. The authors report,

"Regarding sleep architecture, during the exposure night a significant decrease in REM sleep from 17.07% to 13.91% could be observed ($p<0.05$) while all other sleep stages were not significantly affected."

"During REM sleep, an increase of the mean power density (of EEG signals) *was found in all frequency bands, whereas the other sleep stages showed again a decreasing tendency for all frequency bands* (of EEG signals)."

"REM sleep plays a special physiological role for information processing in the brain. Here selecting, sorting, and consolidating of new experiences received during the waking state were performed as well as linking them together with old experiences. For this reason, modification of REM sleep patterns induced by electromagnetic field may be associated with an alteration of mnestic (relating to memory) *functions and learning processes."*

It is probably correct that a well-informed citizen would not want to his family near an RF source for which there is evidence of both a shortening or REM sleep and a fundamental change is the brain wave signals throughout sleep. How much this may effect subsequent memory retention and learning is unknown - but clearly fundamental processes are being changed. Whether an idividual family wishes to accept whatever unknown risk there may be is an personal decision. However, the FCC should not mandate "safe" exposure limits that are 10 fold higher than the levels at which these changes were observed

Recommended limits

Rather, a 10 fold factor should be applied to arrive at a 'guesstimate' of a threshold, for experiments similar to that done, and a traditional 100 fold 'safety' factor to take into account chronic exposure effects, differnces in individuals, effects of medications and other factors.

The above yields a reasonable exposure limit of 1/1000th of that exposure at which an adverse effect was observed (here reduced REM and changed REM sleep), e.g. for cellular phones the limit would be 50 microwatts/1000 = 0.05 microwatts/sq. cm. = 50 nanowatts/sq. cm.

It is also important to note that this effect may most strongly affect infants and small children. It is reported that

"The head resonance occurs at frequencies such that the head diameter is approximately 1/4th of the free space wave length. For the intact adult human head, the resonance frequency is estimated to be on the order of 350-400 MHz. At head resonance the absorption cross section is approximately 3 times the physical cross section with a volume averaged SAR that is about 3.3 times the whole-body SAR." [Gandhi, 1980]

Since the cellular phone wave is about 13 inches, 1/4th is about 3.3 inches, which is not much smaller than the size of a newborn infant's head, especially if low birthweight. Hence, young infants may absorb the most energy from the cellular wave. Moreover, since infants sleep a lot, and much of this time is during the day and early evening when wireless phone use is high, the infants sleep at the times at greatest risk to absorbing high amounts. Finally, integrating experiences and memory for the purposes of learning is a key function in early infancy Thus, infants are likely at greatest risk from the effect observed

The FCC cannot ignore this finding. It must act, given the observed change in REM sleep.

Please note, research needs to determine if this above level is sufficient [(e.g. below will be shown an experiment where increased ovulation rates occurred at levels of 0.00000002 microwatts/sq. cm. (0.02 picowatts/sq. cm.))

Whether accomplished by use of satellite signals, mitigation efforts concerning building attenuation, people must be able to sleep without this change in sleep patterns occurring, and until an operator can demonstrate this is achieved, power density must be lowered accordingly.

50 μW/cm² 4 -Chromosomal aberrations in Yugoslav radar workers. (note: while the documentation in this study was poor, it cannot be dismissed for this reason. Garaj-Vrhovac (1990)

0.08 5. Ultrastructure changes in the hippocampus part of the brain, deemed pathological by the author (some slight adverse effects at 10 microwatts/sq. cm. at 2800 MHz for the rat)

0.05 6. 2 fold increase in leukemia among children living near TV and FM radio towers (the high risk group was exposed to 2 to 8 microwatts / sq. cm.) Since of this mixture FM has the lowest limits, even if we assume all of the exposure was from the FM we still find that the exposure was less than 1/20th of the 200 microwatt/sq. cm. limit in IEEE 1991 for FM exposure. [Microwave News, NOV./DEC 1995]

A look at ovulation/miscarriage concerns:

'extremely low' 1 day old White Leghorn chicks were irradiated at 6000 MHz at 0.0004 microwatts/sq.cm. (400 picowatts/sq. cm) and at a level 20,000 times lower at 0.00000002 microwatts/sq. cm. (0.02 picowatts/sq. cm) were exposed up to 476 days. Dosimetry was not exact. Birds were grouped in copper screened cages and exposures could vary. Yet, it is clear the irradation level was 'very low' in the high exposure group, and 'extemely low' in the low exposure group

A 14% increase in both treatment groups in number of eggs laid compared to controls resulted. 8 other treatment groups, 4 at each level of exposure that were exposed for only about 56 days at different stages in their life, showed results almost identical to controls. Only those chickens continuously exposed showed increased egg laying. No other significant effects or any effects deemed "adverse" were found. The authors hypothesized,

> *"Therefore, the effect of microwave irradiation was only to increase the frequency of ovulation, as manifested by increased rate of lay, possibly through the stimulation of the pituitary."*
> [Kondra, P et al., "Growth and Reproduction of Chickens Subjected to Microwave Radiation," Canadian Journal of Animal Science, Vol 50, No. 3, December 1970, pages 639-644]

Supporting evidence that ovulation and related processes may be affected at extremely low levels of exposure. Consider that if the hormonal system of chickens can change to cause more frequent ovulation in a bird bred to frequently lay eggs, perhaps in animals or in human beings with much longer gestation times, hormonal disturbances may result in decreased fertility - consider the following:

> 1. "Mikolaichyk (1987) has reported changes in concentrations of FSH (follicle stimulating hormone) and LH (leutinizing hormone) in hypothalmus of rats beginning with a single exposure at 0.01 mW/sq. cm." (e.g. 10 microwatts/sq. cm) or roughly 8% of the level considered 'safe' by IEEE 1991. [in Navakatikian, 1994]
>
> 2. *"For all power densities, a decrease in the reproductive function of females, a decrease in litter size, and changes in postembryonic development of offspring were observed. The magnitude of the the changes increased with power density. The number of stillborns increased from 1.1% at 10 microwatts per sq. cm. to 7% at 50 microwatt/sq. cm."*
> [McRee, 1980]
>
> 3. *"In summary, in this study, women who reported using microwave diathermy at the time of conception were at increased risk of miscarriage. The risk increased with exposure, and persisted even when known counfounders wer taken into consideration in the analysis."*
> (Ouellet-Hellstrom 1993)

While each of theses studies may have a weakness, and I believe for most if not all there there has not been an attempted complete replication. Yet the sum total of these, putting aside other studies showing effects at both higher and lower exposure levels [see EPA attached list] it is reasonable to apply to a level of 0.1 of the IEEE 1991 a 10 fold factor to 'guesstimate' a threshold, and a traditional factor of 100.

The results is a 'safety limit' of 0.1% of current power density levels. For cellular telephone exposures this would be 0.05 microwatts per sq. cm.

Another approach is to consider the lowest level at which there was an effect (#6) and apply a 'safety factor' of 50 to the exposure which was 5% (0.05) of the IEEE 1991 'safe' limit. This also results in new 'safety' limits that are 0.1% of IEEE 1991 protection limits.

Other comments: It is correct there may be 'frequency specific effects.' But a conservative public health approach requires assuming there is not, until proven otherwise. However, the adverse effects above include frequencis near those of FM, TV, cellular, and Personal Communications Services, and above them as well. Thus, while specific effects may depend on frequency, adverse

effects are being found across a range of frequencies. Thus, it is reasonable to be conservative and assume as was done above.

Implementation issues of the proposed exposure:

Some may say that any implementation of the above limit of applying 0.1% to the IEEE standard in the range where SAR is applicable should consider feasibility against the weight of evidence for risk and thus conclude that these more strict limits should only apply to new services or existing personal wireless services. This is because:
(1) Almost all of these studies, and other studies discussed herein were in the frequency range of about 900 MHz to 3000 MHz, and these correspond to the frequencies of personal wireless services,

(2) The main new construction will be for such services, and they will be effecting much of the nation, and far more than current TV and AM/FM stations, and

(3) The 'hot spot' range for human body covers the above range, with 915 MHz being near the optimum for hot spots, with a 'hot spot' in the center of the head near both the brain and endrocrine glands that are expected to affect many body functions (e.g. pineal producing melatonin and the pituitary) - thus it is a reasonable speculation that a mechanism exists for low level effects to concentrate in 'hot spots' and have an effect

In addition based on the literature and presentations made to regulatory authorities it seems it is feasible for these exposures to be met. Consider, for cellular phone exposures the limit would be 50 nanowatt/sq. cm. To see it is feasible for these networks to operate within these limits consider:

(i) A research study of exposures from cellular base stations [Petersen and Testagrossa, 1992] reported what were considered typical base station ground level (2 meters above ground) power density exposures. Fig. 2 from this paper shows that beyond 40 meters, up to 25 channels can be in use simultaneously and still meet the exposure requirement, and Fig. 4 shows that at all distances, 25 channels could operate simultaneously [See Exhibit #4]

(ii) Similarly, at a presentation to the California Pubic Utilities Commission, July 21, 1993, a presentation was made by PacTel Corporation. 2 examples of 'typical' base station antennas which were presented are included here. Figure MHZ534T03 shows that for all distances 16 channels could operate simulataneously and if there were no structures within 80 meters then 50 channels could operate. Similarly, for MHZ534T05, beyond 40 meters 16 channels could operate and beyond 60 meters over 50 channels could operate

Note: it is also the case that if antennas are built at relatively low heights (35 to 45 feet or less) then exposures can be great because the upper floors of buildings may be in the path of the powerful main horizontal beam. In these cases, proposed FCC limits can be reached. See Exhibit for 3 examples.

Thus, if there is the will to put antennas up high to keep exposures low, and this consideration is provided to local jurisdictions, then ways may be found to have both visually appealing and high safer antennas (e.g. 'look-like-a-tree' antennas up to 200 feet high)

Thus the proposed limits are feasible for personal wireless services if there will be high antennas

This need for keeping exposures low again indicates the need to pursue exploring the feasibility of using satellites to broadcast transmissions, and land based ground stations near users to receive signals from users and send them back up to satellites. But this takes planning, coordination, will, and research efforts to determine the feasibility and limits of such a possibility. Will FCC lead?

Thank you for giving this important matter your attention. Attached please find further discussion and details which should be considered as an integral part of this letter.

Resepectfully yours,

David Fichtenberg

see Exhibit

Technical Details for some points:

1. Credibility problems due to IEEE unbalanced voting and inadequate review process. 3

Inadequate balance of interests: The IEEE development and voting process weakened the credibility of the standard. This is because the balloting committee lacked sufficent public health representation with only 3 of 36 members being from a public health agency (all from the Food and Drug Administration (FDA) Center for Device and Radiological Health), while 31 were users of radio frequency or consultants or contractors to users (27 voted). See distribution below.

Balloting Committee for IEEE 1991 by company association 36 members, 32 voted See Exhibit 3

31 Users of Radio Frequency or contractors or consultants to users (27 voted)

	16	Dept. of Defense (Army 4, Navy 7, Air Force 5)
	7	Private companies(not utlitities) and private consultants (e.g. AT&T Bell Labs, Motorola, Raytheon Research)
	3	Utilities (Florida Power & Light, Houston Power and Light, New York Power)
	5	Universtiy departments or laboratories of physics, engineering, bioengineering, bioelectromagnetics (presumably contractors and consultants to users)
3	3	Health agency representatives (all FDA Center for Device and Radiological Healht
2	2	Other: 1 University + NIST (National Inst for Standards and Technology of Dept. of Commerce - a user of RF

66% (2 of 3) IEEE members from health agencies (the FDA) voted to against adoption of IEEE 1991 (Dr. Mays Swicord and Dr. M. Altman). Explaining his negative vote, Dr. Swicord wrote, and Dr. Altman concurred, that,

"I feel that the procedures agreed upon concerning membership and circulation of this document have not been fully carried out. A membership committee was appointed to consider proper balance of representatives. To my knowledge this committee never met. It is generally recognized that current membership is not balanced in representing government (e.g. regulatory health agencies), *industry* (e.g. users of radio-frequency), *and the general public. Thus, the ballot may not represent a proper balance."* [see IEEE ballot and comments attached in Exhibit #3

Lack of public health perspective: The above lack of balance also disturbed the National Institutes of Occupational Safety and Health (NIOSH) who wrote the FDA that,

"NIOSH is concerned about the lack of participation by experts with a public health perspective in the IEEE RF standards setting process " [NIOSH letter from R. Niemeier of Jan. 11, 1994 to the FCC]

NIOSH also criticized IEEE 1991 for being weak because it considered few epidemiology studies, and wrote,

"For example, epidemiology studies were categorically rejected as not useful in the process of setting ANSI/IEEE C95.1-1992 limits. This lack of public health perspective creates a weakness in the standard that should be acknowledged by the FCC..." [NIOSH letter of Jan. 11, 1994 from R. Niemer to the FCC]

Note that IEEE 1991 did contain one study of RF and heart disease, and found an *adverse* effect [Hamburger et al. 1983 on IEEE final list pg. 64]. While supporters of IEEE 1991 claim there

were 11 epidemiology studies, the remaining 10 were short term studies exposing people for minutes or less to determine criteria for induced currents, contact currents, RF burns and perception studies, power absorption in the body, heating effects of short millimeter waves and did not address effects of chronic low level exposure which is of great public health concern.

Lack of review by health agencies of drafts of IEEE 1991: No agency review of the IEEE draft occurred as had been planned, since Dr. Swicord also wrote,

"Secondly, we agreed at the fall meeting in 1989 to send out this document for agency review and comment...if the standard is to have credibility I feel it is necessary."

Thus, it appears the IEEE 1991 did not follow its own agreed upon procedures to have agencies review and comment on a draft of IEEE 1991

Lack of consistency between exclusion clauses and basic provision of standard: Dr. Swicord wrote as a reason for his "No" vote,

"An inconsistency between the exclusion clause and the basic standard."

Lack of proper justification for allowing increased exposure: Dr. Swicord, wrote, with the concurrence of Dr. Altman,

"The standard has been increased at the higher frequencies from the 1982 versions with very weak justification. However, the appearance of arbitrarily increasing the level for practical engineering considerations with no health consideration will cause undue public concern of the committees actions. The justification should be strong and make sense or the values should be reduced to 1982 levels."

Lack of sufficient careful review of the scientific literature: Concerning how well the IEEE 1991 committee reviewed the scientific literature, Dr. Swicord expressed concern that important studies on pulsed RF was not getting appropriate attention, and he wrote,

"There is other data (work of Kues and others) which suggests that pulsed microwaves may give responses at lower average levels than CW (continuous wave). This problem should not be brushed aside."

The work of Henry Kues (Kues, 1985, 1992) has shown eye damage (degenerative changes in the retina, iris, and cornea) in monkeys occurs at lower levels with pulsed than with continuous wave signals, and that these occur 65% below the IEEE 1991 selected whole body hazard threshold, and occur 6.5% below this hazard threshold when the glaucoma medication, timolol maleate is given. Also when this glaucoma medication is given, eye damage was observed at 16% of the level deemed safe for localized irradiation of the eye in IEEE 1991

Note that (Kues, 1985) was on a preliminary list of papers a IEEE 1991 sub-committee evaluated for the selection of the Final List of Papers Reviewed for IEEE 1991. It is not clear why this paper was removed from subsequenct consideration by IEEE 1991.

As noted elsewhere in this report, the FDA, National Institures of Occupational Safety and Health (NIOSH), and EPA concurred with the view that important available studies were not properly considered, and that this weakens IEEE 1991 credibility Likewise, at a 1993 EPA conference, members of an expert panel voiced a concern consistent with this view and noted that current

non-federal standards did not consider important studies. The letter from Dr. Swicord and concurrence by Dr. Altman further substantiate that this indeed some important problems were "brushed aside."

Lack of majority rule prevents elimination of a claim made by IEEE working groups which EPA finds 'unsupported': It is important to note that apparently 'majority rule' was not followed to allow modifying the drafts of IEEE 1991 As a result of a 2/3 majority requirement for changing draft text, a claim which was not supported by an EPA agency peer-reviewed and Scientific Advisory Board reviewed report, nevertheless was able to remain in IEEE 1991. This occurred despite the efforts of Dr. Herbert Pollack, one of the two physicians on the committee reviewing the draft to try to get it deleted. Dr. Joe Ellder, of the EPA and member of IEEE, was reported to have found the vote refusing to eliminate this false claim "incredible." [all the material in this section is based on Microwave News September/October 1989]

Note: the claim in dispute was that "there was no reliable scientific evidence that certain subgroups of the population were at greater risk than others " [IEEE 1991 pg. 23]. But but an EPA report which studied a 16 year period in the U.S in which there were 5 heat waves found:

1- "...there was an excess of deaths from hypertensive heart disease in May, June, or July in each of the heat wave years but not in 10 of the other 11 years."

2- "Infants below 1 year of age are the most heat-illness-prone age group below 50 years of age: adults above 50 years are more heat-illness prone than infants and become progressively more so with advancing age."

and therefore,
3- "the general population has groups of individuals particularly susceptible to heat." [EPA, 1984,pg. 6-9]

It is not clear why the IEEE 1991 committee did not accept the findings of one of its two physicians nor of the EPA which based its conclusions on science based Vital Statistics Reports of the U.S. Public Health Service.

Consequently, EPA reported in its letter to the FCC that,

"The 1991 ANSI/IEEE conclusion that there is no scientific data indicating certain subgroups are more at risk than others is not supported by NCRP (1986) or EPA reports." [EPA letter to FCC, 1993]

There are credibility problems due to IEEE examined papers having adverse effects *below* levels IEEE claims was a 'threshold.' Hence it is unclear what protection is accorded by IEEE 1991. Consequently the proposed power density limits should be rejected. Instead, exposure limits based on a hazard threshold equal to the lowest exposure at which an adverse effect was identified amongst the 120 final list papers reviewed by IEEE 1991 after careful sceening of papers should be the highest hazard level the FCC should consider. From these protection limits can be derived using traditional 'safety factors' Based on additional findings lower hazard limits may be considered (see below)

Studies of live animals which found 11 adverse effects below the hazard threshold selected by IEEE 1991 were also reported in IEEE 1991. These papers on found in IEEE 1991 Appendix B: Final List of Papers Reviewed for IEEE C95.1-list. Below is a summary of these effects and the percent the associated exposure was of the IEEE hazard threshold.

Notice that these studies with adverse effects at low levels find primarily cancer and central nervous system effects (either behavior denegration or changes in nerve tissue or function).

For detailed reference see next page of IEEE C95.1-1991

	% of IEEE 1991 hazard threshold
IEEE 1991 protection limits:	
IEEE 1991 'safe' limit for less restrictive tier, current FCC limit	10%
IEEE 1991 'safe' limit for more restrictive tier	2%

(After effects below is the key author, year published, and page in IEEE 1991 which the paper is referenced on the Final List of Papers Reviewed Review for C95.1-1991 (e.g. IEEE 1991)

Live animal studies include:

1) Acceleration of cancer by injection of sacroma cancer cells in mice (Szmigielski, 1982, referenced on IEEE 1991 pg. 67)	75%
2) Acceleration of cancer by application of a skin cancinogen in mice (Szmigielski, 1982, pg. 67)	75%
3) Acceleration of cancer in mammary cancer prone mice (Szmigielski, 1982, 67)	75%
4). Breakdown of learned and innate behaviors in rats (Mitchell, 1977,66)	58%
5) Increased frequency of anomalies (myelin figures) in dendrite nerve cell endings in animals showing a breakdown in learned and innate behavior in rats (Switzer, 1977, 67)	58%
6) Fetal anomalies: canioschisis (incomple cranial development, plus a "panorama" of other anomalies which in the aggregate were statistically significant, but which the authors were "not prepared" to accept was due to microwave radiation (Berman, 1978, 61)	50%
7) Disruption of learned behavior where rats learned to wait a set time	30%